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Transformation of *Rhodiola rosea* with *rol*-genes from *Agrobacterium rhizogenes*
– a platform to enhance production of the secondary metabolites salidroside and rosavin

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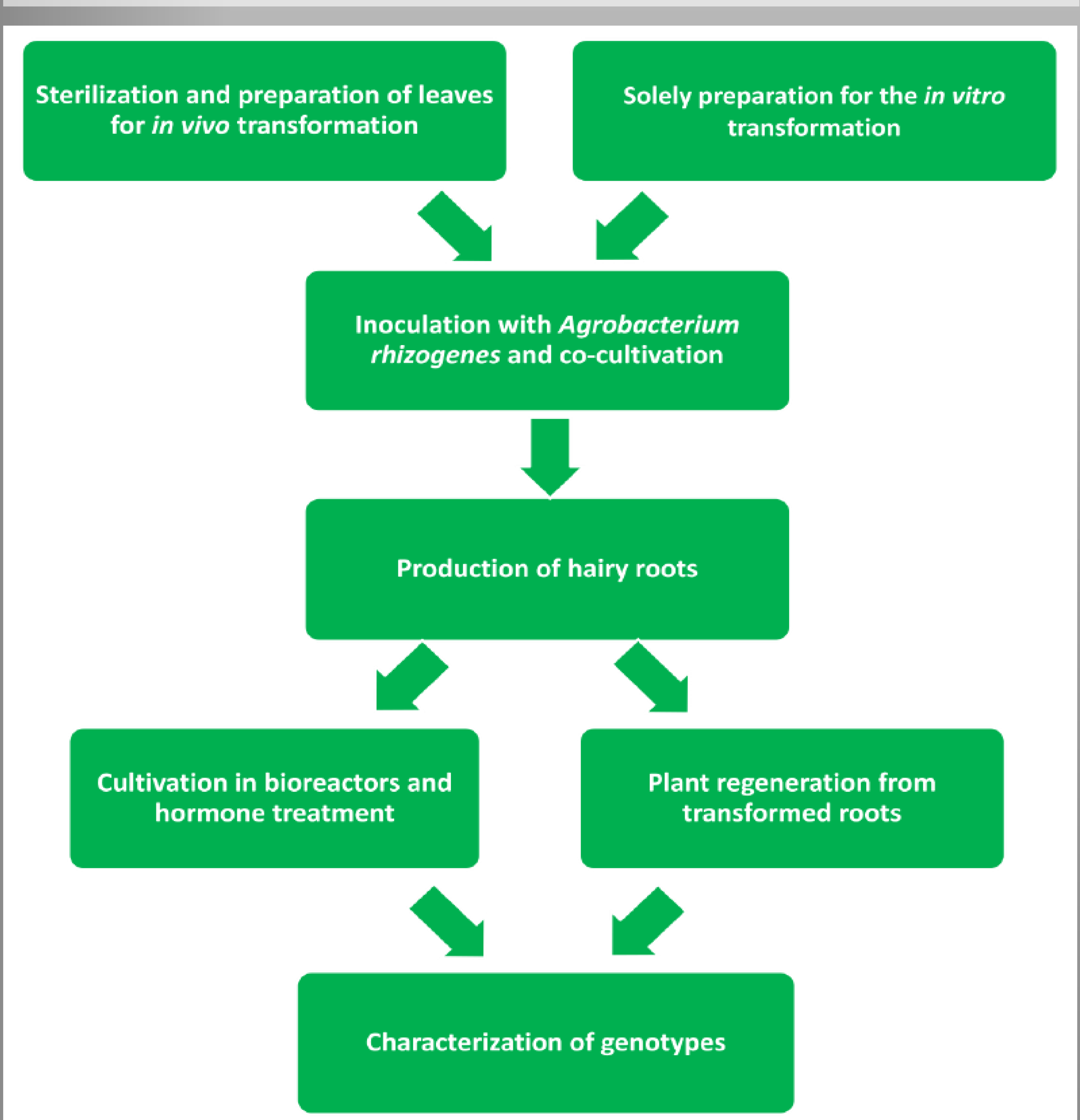
Key result
~60 % of the transformed explants developed hairy roots

Introduction
Rhodiola rosea L. (Fig. 1a) also known as roseroot is an arctic alpine plant distributed on the Northern hemisphere[1] (Fig. 1b). The plant contains among others the secondary metabolites rosavinoids and salidroside[2] (Fig. 2). These composites are active compounds that have been used for centuries to alleviate depression, stimulate the memory and as anti-fatigue and anti-inflammatory agents.

Transformation with *root oncogenic loci* (*rol*) genes from *Agrobacterium rhizogenes* leads to development of hairy roots at the infection site[3]. Transformed hairy roots have, for several plant species, been shown to contain higher contents of secondary metabolites compared to wild type[4].

Objectives
- To obtain hairy roots of *R. rosea* containing *rol*-genes for future sustainable production of valuable bioactive compounds in bioreactors.
- To enhance the level of bioactive compounds *in planta*.
- To regenerate plants from transformed roots.



Experimental design. The structure of the workflow behind the experiment for cultivation and regeneration of the putatively transformed hairy roots.

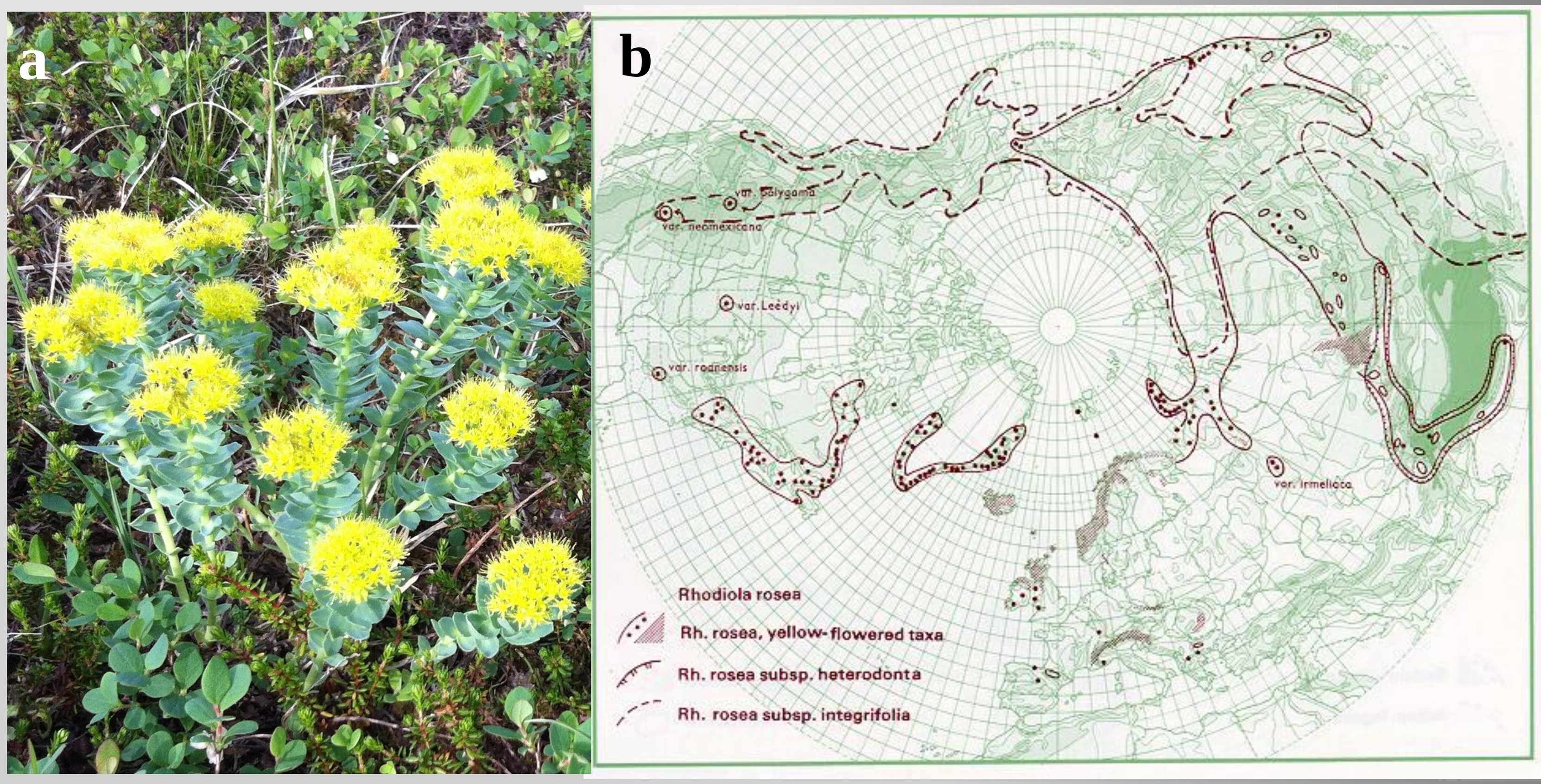


Figure 1. *Rhodiola rosea.* a) plant habitus b) geographical distribution of *R. rosea*

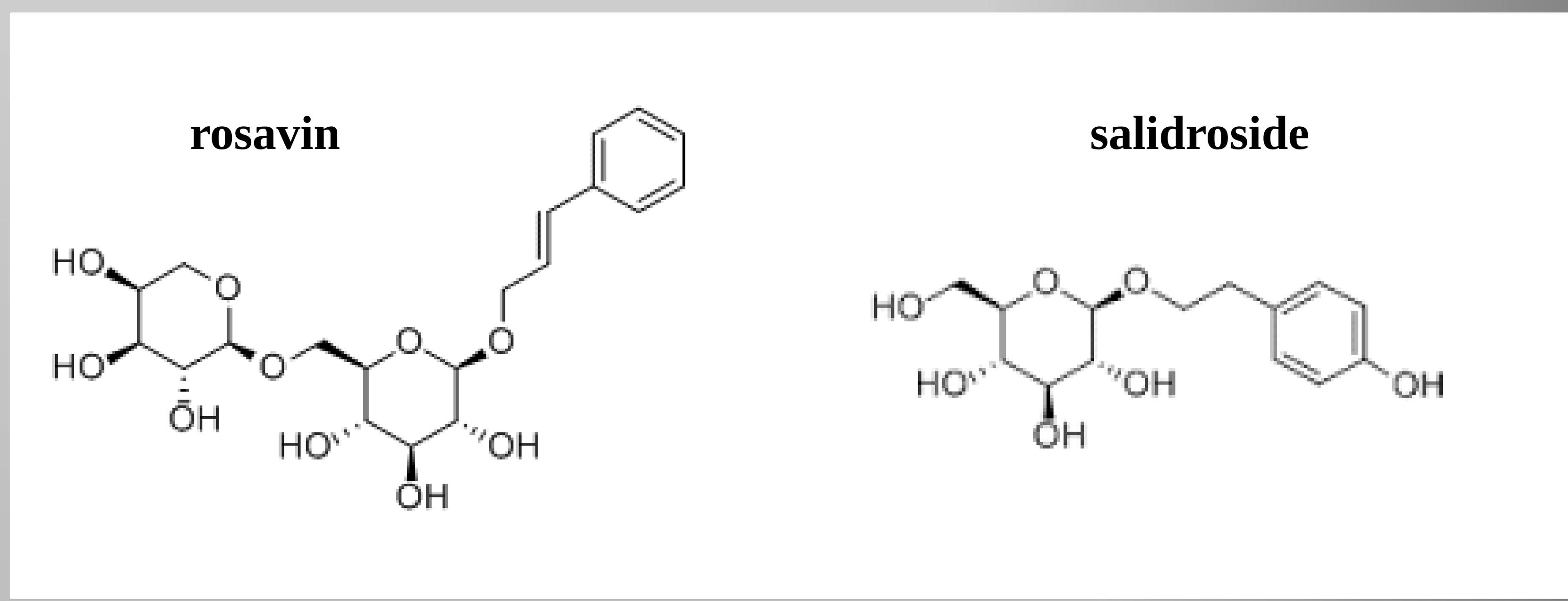


Figure 2 Structures of important secondary metabolites in *R. rosea*

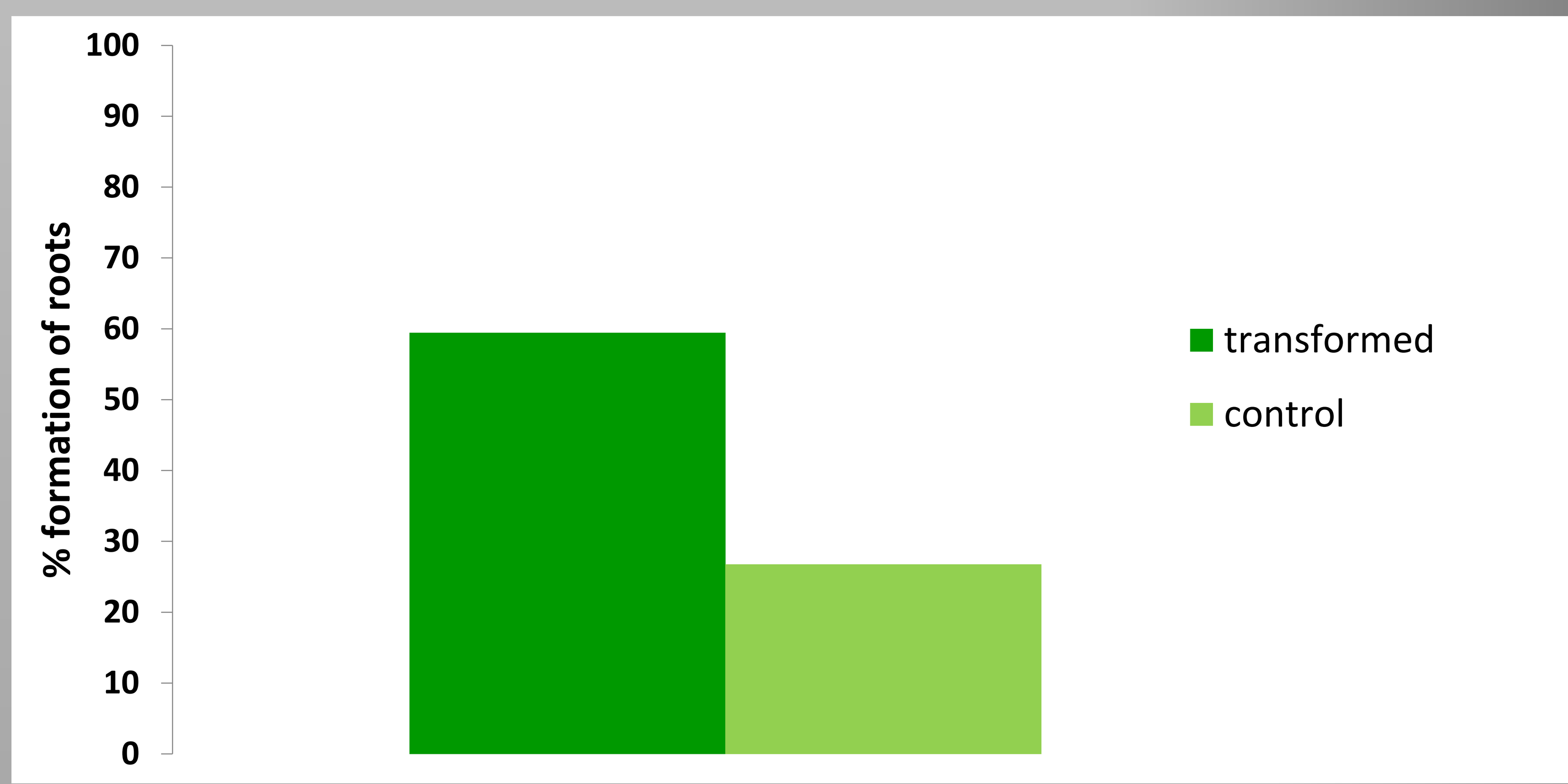


Figure 3. Root formation following transformation. *R. rosea* was subjected to *A. rhizogenes* (transformed, n=74) or MYA (control, n =71).

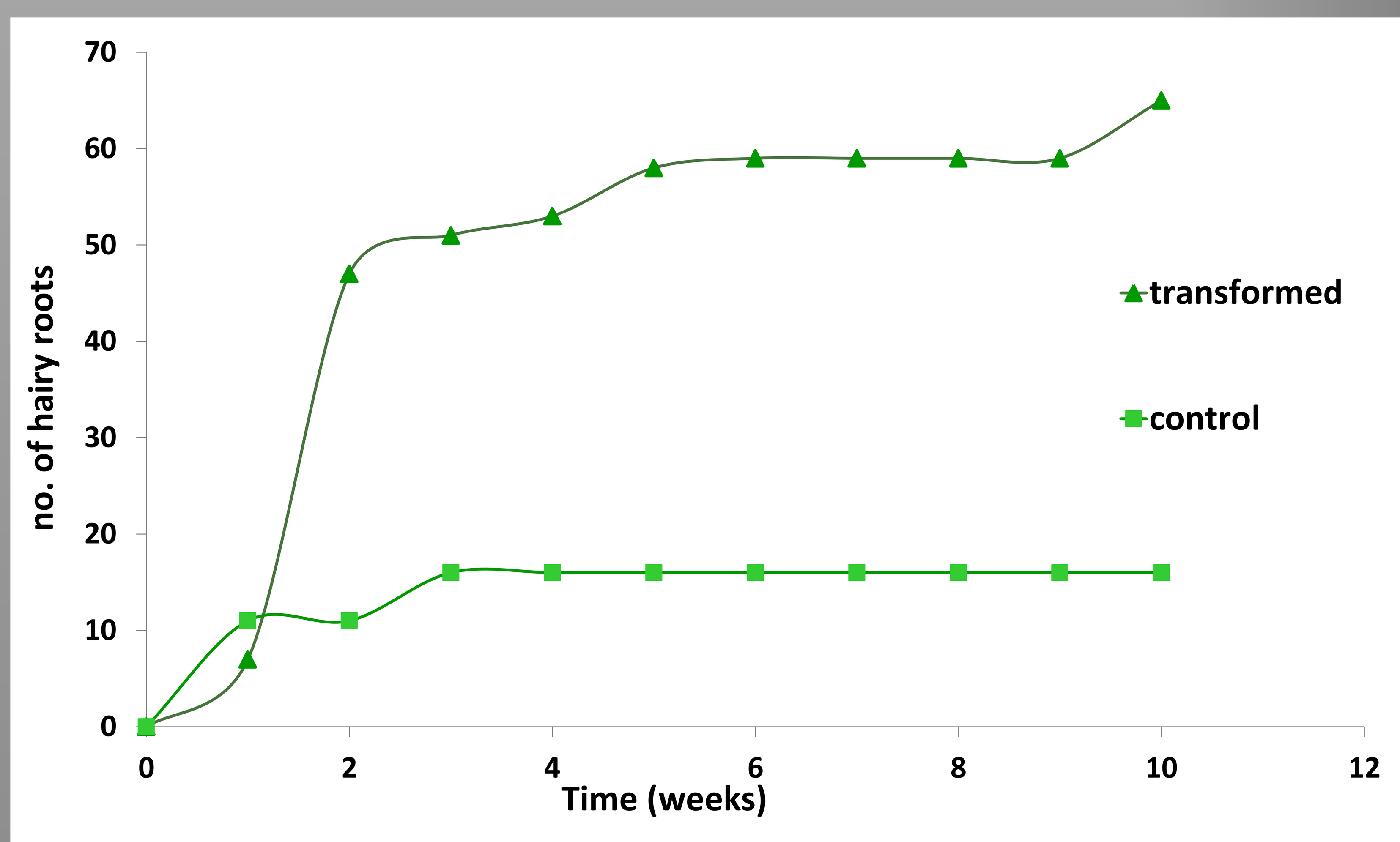


Figure 4 Hairy root development. *R. rosea* was subjected to *A. rhizogenes* (transformed, n=74) or MYA (control, n =71)

Preliminary results
- **Approximately 60 % of the transformed explants developed hairy roots (Fig. 3).**
- **Collectively the transformed explants developed hairy roots faster than the controls (Fig. 4).**

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3) Kiselev, K. V et al., 2007. The rolB gene-induced overproduction of resveratrol in Vitis amurensis transformed cells. *Journal of biotechnology*, 128(3), pp.681–92.

4) Britton, M.T. et al., 2013. Chapter 14 THE ONCOGENES OF AGROBACTERIUM TUMEFACIENS AND AGROBACTERIUM RHIZOGENES. *Springer*, pp.523–563.